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MEMORANDUM

TO: Al Nielsen/John Leahy

cc: Tim Leighton
Sally McDonald
2994.102 file

FROM: Tom Brennan

DATE: January 25, 1996

SUBJECT: Vinclozolin RED

Attached is a draft copy of the Vinclozolin RED chapter. The following is a list of issues that need to be addressed:

- Strawberry, peach, and turf data from the following FDR and reentry studies were used in this RED chapter: MRID Nos. 428300-01, 428300-02, 430130-03, 430130-04, 430130-05, 435287-01, and 433437-01,02. However, due to time constraints these studies have not yet been thoroughly reviewed by Versar. These reviews will be completed in the near future. MRID No. 435059-01 was reviewed by Versar and submitted to OREB on July 25, 1995.

- The Transfer Coefficients for strawberry and peach harvesting derived from the chemical-specific FDR and reentry studies are low (ranging from 749 to 2,907 cm^2/hr). Transfer Coefficients around 10,000 cm^2/hr are more typical for these activities.

- The Transfer Coefficient for Jazzercise on turf derived from the actual dissipation data (8,547 cm^2/hr) is dramatically different for the "Best Fit" FDR (17,666 cm^2/hr). As per our conversation on December 29, we decided to use the actual dissipation data to create the transfer coefficient (8,547 cm^2/hr).

- The sprinkler irrigation use has been removed, since the labels indicate that this product cannot be applied through any irrigation system.

- The wording on the labeling (ornamental landscape uses) plus the fact that vinclozolin is a fungicide make it unlikely that there are wide-area aerial forestry applications of 1200 acres per day.

- The current tables do not differentiate between fixed-wing and rotary-wing aircraft for mixing/loading or flagging, but do differentiate between the two aircraft for application. For application, it is assumed that maximum daily acres treated by rotary-wing is 350 acres; whereas maximum daily acres treated by fixed-wing aircraft ranges between 350 acres for crops to 500 acres for sod farms to 1,200 acres for forests.

Should tables be expanded to differentiate between the two aircraft for mixing/loading and flagging activities? OREB: No.

- Application to turf using groundboom equipment has been added to the use-scenarios.

- Should the backpack sprayer and low-pressure sprayer scenarios include turf (higher application rate) as well as crops for homeowner and occupational applications? OREB: Yes.

- Possible engineering control for the dry flowable formulation is water-soluble packets. Should this be calculated to determine if the MOEs would be greater than 100? OREB: No. Would the calculations be the same as for WP or would we add a protection factor to the dry flowable data? OREB: Hold for now.

- How should intermediate-term exposure be expressed? Seven days per year??? Seven days per crop-production cycle? OREB: 7 days per 90-day period.

- As per OREB's direction, no assessment was calculated for the soil study (MRID No. 430130-05).

- The application rates (1.0 lb ai/A for crops; 4.0 lb ai/A for forests; and 5.5 lb ai/A for turf) were obtained through John Leahy.

If you have any questions, please call me at (703) 750-3000.

December 9, 1997

MEMORANDUM

SUBJECT: OCCUPATIONAL AND RESIDENTIAL EXPOSURE ASSESSMENT AND RECOMMENDATIONS FOR THE REREGISTRATION ELIGIBILITY DECISION DOCUMENT FOR VINCLOZOLIN

TO: Debra Edwards, Branch Chief
Risk Characterization and Analysis Branch
Health Effects Division (7509C)

FROM: John Leahy, Environmental Protection Specialist

THRU: Alan P. Nielsen, Section Head
Reregistration Section II
Occupational and Residential Exposure Branch
Health Effects Division (7509C)

Larry C. Dorsey, Chief
Occupational and Residential Exposure Branch
Health Effects Division (7509C)

Please find the OREB review of vinclozolin.

DP Barcode:	D212380
Pesticide Chemical Codes:	080814

EPA Reg. Nos.: 7969-53, 7969-85, 58185-17, 372-60, 7969-62

EPA MRID Nos.:	430130-05, 430130-04, 430130-03, 428300-02, 428300-01, 423424-01, 424831-01
LUIS Report Date:	4/3/95
PHED:	Yes, Version 1.1

OCCUPATIONAL AND RESIDENTIAL EXPOSURE CHAPTER

In this document, which is for use in EPA's development of the Vinclozolin Reregistration Eligibility Decision Document (RED), EPA presents the results of its review of the potential human health effects of occupational and residential exposure to vinclozolin. Included is a discussion of the adequacy of the occupational and residential exposure data that have been submitted in support of the reregistration of vinclozolin.

(RED SECTION III - TOXICITY, EXPOSURE, AND RISK)

(EXPOSURE)

Occupational and Residential

An occupational and/or residential exposure assessment is required for an active ingredient if (1) certain toxicological criteria are triggered and (2) there is potential exposure to handlers (mixers, loaders, applicators, etc.) during use or to persons entering treated sites after application is complete.

Use Summary

Use Patterns

Vinclozolin, [3-(3, 5-dichlorophenyl)-5-ethenyl-5-methyl-2,4-oxazolidinedione], is a fungicide used on a wide variety of food and non-food crops.[1] Vinclozolin is formulated as a dry flowable (50 percent active ingredient), liquid flowable concentrate (41.3 percent active ingredient), and a wettable powder (50 percent active ingredient).[2]

Vinclozolin can be applied with aerial equipment, groundboom sprayers, backpack sprayers, foggers (greenhouses), air blast sprayers, high pressure handwands, low pressure handwands, and dip treatment.[1,2] Application rates vary from 0.62 to 5.5 lb ai/acre.[1] Vinclozolin is applied to the following crops:

Food Crops:

Snap beans, apricots, cherries, chicories, kiwi fruit, lettuce, nectarines, onions, peaches, prunes, raspberries (black, red), and strawberries.[1]

Non-Food Crops:

Forest trees (e.g., broadleaf and conifers), both greenhouse and outdoor ornamentals (e.g., trees, herbaceous plants), and turf/lawns (e.g., sod farms, golf courses, and residential turf).[1]

Occupational-use products and homeowner-use products

At this time some products containing vinclozolin are intended primarily for occupational use and some are intended primarily for homeowner use, including use on lawns, fruit/vegetable gardens, and landscape gardens).

Acute Toxicity

The toxicological data base for vinclozolin is adequate and will support reregistration. Guideline studies for acute toxicity indicate that vinclozolin (test material not identified) is classified as category III for acute oral toxicity, category III for acute dermal toxicity, category IV for acute inhalation toxicity, category III for eye irritation potential, and category IV for dermal irritation.[3] Vinclozolin is classified as a skin sensitizer.[3]

Other Endpoints of Concern

The *Toxicological Selection Endpoint Document*, dated 11/21/95, indicates that there are toxicological endpoints of concern for vinclozolin. Two endpoints have been identified: a short-term NOEL of 60 mg/kg/day (dermal maternal toxicity study); and, an intermediate-term NOEL of 1.2 mg/kg/day (oral 2-year toxicity study).[3] Because the short-term study was a dermal toxicity study, it is not necessary to apply a dermal absorption value. However, for the intermediate-term toxicity study, a dermal absorption of 25.2 percent was used.[3]

Handler Exposures & Assumptions

EPA has determined that there is potential exposure to mixers, loaders, applicators, or other handlers during usual use-patterns associated with vinclozolin. Based on the use patterns described above, 13 major exposure scenarios were identified for vinclozolin:
(1a) mixing/loading dry flowables for aerial applications; (1b) mixing/loading dry flowables for groundboom applications; (1c) mixing/loading dry flowables for airblast sprayer;
(2a) mixing/loading wettable powder for aerial applications; (2b) mixing/loading wettable powder for groundboom application; (2c) mixing/loading wettable powder for airblast sprayer;
(3a) mixing/loading liquid flowable concentrate for aerial applications; (3b) mixing/ loading liquid flowable concentrate for groundboom applications; (3c) mixing/loading liquid flowable concentrate for airblast sprayer; (3d) mixing/loading liquid flowable concentrate for fogger applications; (4) applying as a spray with fixed wing aircraft; (5) applying as a spray with rotary-wing aircraft; (6) applying as a spray with tractor drawn groundboom equipment; (7) applying as a fog with fogging equipment; (8) applying as a mist with airblast spraying equipment; (9) flagging during aerial spray application; (10) mixing/loading/applying as a spray with backpack spraying equipment; (11) mixing/loading/applying as a spray with low pressure sprayer; (12) mixing/loading/applying with a high pressure handwand (greenhouse/ ornamentals); and (13) mixing/loading/applying with a dip treatment.

Two chemical-specific studies have been submitted by the registrant for handler exposure scenarios. These data were pooled with PHED data for this exposure/risk assessment. A brief summary of these two chemical-specific studies are presented below.

- **Study 1: Worker Mixer/Loader Applicator Exposure to Ronilan WP. MRID No. 423424-01.** The purpose of this study was to quantify the potential dermal and inhalation levels through the use of passive dosimetry to test subjects as they performed typical mixing/loading and application activities. Additionally, urine samples were collected to determine actual dose levels up to 48 hours after the completion of each exposure replicate.

  Vinclozolin, formulated as a wettable powder (50 percent ai by weight), was applied using airblast and groundboom (i.e., field crop) equipment with both open and closed cab tractors. Mixer/loader studies were performed using both the wettable powder and dry flowable formulations (i.e., both 50 percent by weight). The study regimen is summarized in Table 1. Per Table 1, samples from five individual exposure replicates were generated and collected during each test except for the aerial mixer/loader tests where only 3 replicates were completed. Also note that mixer/loader and applicator samples were not generated for each scenario. All study activities were completed between July 11, 1990, and August 30, 1990.

Table 1. Study Regimen Survey

Test Number	Vinclozolin Formulation	Location	Application Equipment	Cab Type	Crop Type	No. Replicates/Test	
						M/L	Applicator
1	50 WP	Easton, CA	Airblast	Open	Apricots	0	5
2	50 WP	Chowchilla, CA	Airblast	Closed	Apricots/ Plums/ Peaches	0	5
3	50 WP	Williamson, NY	Airblast	Open	Cherries	5	5
4	50 WP	Firebaugh, CA	Groundboom	Open	Bare Ground*	5	5
5	50 WP	Firebaugh, CA	Groundboom	Closed	Bare Ground*	5	5
6	50 WP	Huron, CA	Groundboom	Open	Lettuce	5	5
7	50 WP	Caruthers, CA	Aerial	N/A	N/A	3	0
8	50 WP	Fresno, CA	Aerial	N/A	N/A	3	0
9	50 DF	Caruthers, CA	Aerial	N/A	N/A	3	0
10	50 DF	Fresno, CA	Aerial	N/A	N/A	3	0

* Bare ground was used in the treatments during test numbers 4 and 5, respectively, because of a "lack of useable head lettuce and strawberry acreage on the central coast of California, [as a result] the two central coast tests were conducted in the San Joaquin Valley on bare ground. Approval was received from the California Department of Food and Agriculture before bare ground applications were made."

According to the study report, "Ronilan fungicide was used at the highest label rate for these crops [see Table 1] which is 2.0 pounds (1 lb ai) per acre and mixed in spray volumes of 20 to 100 gallons (20 gallons for aerial, 50 gallons for airblast, and 100 gallons for row crop) per acre (gal/acre). The average amount of active ingredient handled or applied [per test] was 21.1 kg" while the range was 16.5 kg to 22.5 kg of active ingredient handled. The amount of vinclozolin handled was equally apportioned among the number of replicates per each test (i.e., 3-5 replicates). Finally, although aerial applications were not performed, mixer/loader exposures for aerial application scenarios were monitored. "For the aerial tests, Ronilan was mixed in a nurse tank and pumped into the holding tank" - this procedure was designed to simulate the loading of an agricultural aircraft.

A total of 34 test subjects were involved in this study, 14 of which handled vinclozolin (i.e., mixing/loading or application) while the remaining 20 either "provided dermal, inhalation or urine control samples" or "additional urine control samples." Each of the 14 test subjects which handled vinclozolin wore "cotton-polyester coveralls over the upper body dosimeters [see below] along with goggles, chemical resistant gloves, and boots." Mixer/loaders also wore chemical resistant aprons as specified by the label. No other details were provided regarding the clothing worn by each test subject that handled vinclozolin (e.g., if typical personal clothing was worn under the coveralls as well as the dosimeters).

Potential "dermal exposure [excluding hands] was monitored using modified Durham-Wolfe patch dosimeters, upper-body dosimeters and forearm swipes. Patches were used to monitor leg exposure; upper-body dosimeters were used to monitor upper-body (back, chest and upper arms) exposure, and the swipes measured lower-arm exposure. After each replicate sampling media was changed and forearm swipes were taken." Additionally, swipes were used to monitor head exposures. Patches were attached to the inside of workers' coveralls facing outward at each thigh and shin. Potential dermal "hand exposure of mixer/loaders and applicators was measured using detergent handwashes."

Potential inhalation exposure "was monitored using a MSA Model S or Model G personal air-sampling pump and filter cassettes." Pumps were calibrated to a nominal flow rate of 1.5 lpm prior to and after each exposure replicate using a Kurtz mass flow meter. "Air-sampling media consisted of a two stage filtering system utilizing a three-piece cassette."

The vinclozolin mixer/loader, applicator, flagger exposure study does not fully meet the specifications outlined in Subdivision U of the Pesticide Assessment Guidelines (U.S. EPA, 1986; U.S. EPA, 1988) because of several criteria. To summarize, the major criteria include: (1) an inadequate number of exposure replicates were performed for this study; (2) the cultural practices associated with

vinclozolin use were not adequately described; (3) no adequate pharmacokinetic data were provided to support the biological monitoring phase of the study; (4) the analytical quality control regimen was inadequate; and (5) the field phase quality control regimen was inadequate (e.g., no discussion was provided regarding decontamination of sampling equipment between replicates).

• **Study 2: Worker Mixer/Loader Applicator Exposure to Ronilan DF. MRID No. 424831-01.** The purpose of this study was to quantify potential dermal and inhalation exposure levels through the use of passive dosimetry techniques as test subjects performed typical mixing/loading, aerial application, and flagging activities. Additionally, urine samples were collected to determine actual absorbed dose levels up to 48 hours after the completion of each exposure replicate.

"The study was conducted in Starbuck and High Bluff, Manitoba, Canada on canola. Fixed-wing aircraft were used to apply Ronilan fungicide to canola at the highest labeled rate, 1.0 kilograms (0.5 kilograms active ingredient) per hectare in spray volumes of approximately 40 liters per hectare. The average amount of active ingredient handled was 171 kilograms for the mixer/loader." The Ronilan DF was from Lot Number 30-2007 and was packaged in 5 pound paper bags. Cessna Ag-Trucks, closed-cockpit, aircraft, were used to make all applications outfitted with typical disc/cone hydraulic type nozzle arrangements.

Each test subject "wore clothing and protective equipment that was in compliance with the proposed label, coveralls or long pants and long-sleeved shirts. Mixer/loaders also wore goggles, protective gloves and chemical resistant boots. Control workers wore their normal clothes." The coveralls were "cotton/polyester" while the remaining clothing materials were not described.

Potential "dermal exposure [excluding hands] was monitored using modified Durham-Wolfe patch dosimeters, upper-body dosimeters, and forearm swipes. Patches were used to monitor legs and feet exposure; upper-body dosimeters were used to monitor upper-body (back, chest and upper arms) exposure; and the swipes measured lower-arm exposure. At the end of the monitoring period, all the dermal body sampling media were removed." Potential dermal "hand exposure of mixer/loaders and applicators was measured using detergent handwashes." Potential "inhalation exposure was monitored using a MSA Model S or Model G personal air-sampling pump and filter cassettes. The air sampling unit was adjusted to draw approximately 1.5 liters of air per minute (lpm) prior to each replicate using a Kurtz Mass flow meter."

"Urine samples were collected from the test subjects to assess total exposure to Ronilan™. Urine samples were collected from each worker and two control workers prior to the start of each test, during the test, and for 48 hours following the test. Each person was asked to collect all urine for that period in separate 1-

quart tin cans; the date and time were marked on each can accordingly. For sample storage, participants were provided with ice chests containing enough dry ice to last for 48 hours. At the end of each day, a Pan-Ag representative collected samples and brought them to a walk-in freezer. After all urine samples were collected, they were categorized by test site, assigned numbers and recorded."

Potential exposure levels (i.e., based on passive dosimetry techniques) as well as absorbed dose levels were presented in the study report. All exposure levels were corrected for field recovery results--laboratory recovery data for all matrices averaged 90 percent or greater. "Out of the three job functions monitored, the mixer/loader had the greatest exposure. Dermal exposure for the mixer/loader ranged from 0.155 mg ai/kg ai handled and inhalation exposure ranged from 0.00158 mg ai to 0.00436 mg ai/kg ai handled. Applicator and flagger exposure was considerably lower ranging from 0.000966 to 0.0184 mg ai/kg ai applied and 0.0000957 to 0.00427 mg ai/kg ai applied for dermal and inhalation, respectively." For mixer/loaders, applicators and flaggers, respectively, mean potential dermal exposure levels were 0.269, 0.0092, and 0.00348 mg ai/kg ai handled. In similar fashion, potential inhalation exposure levels were 0.00246, 0.00023, and 0.00115 mg ai/kg ai handled, respectively, for the mixer/loaders, applicators, and flaggers.

The vinclozolin exposure study does not fully meet the guidelines specified in Subdivision U of the Pesticide Assessment Guidelines (U.S. EPA, 1986; U.S. EPA, 1988) because of several criteria. To summarize, the major criteria include: (1) an inadequate number of exposure monitoring replicates for all but one scenario were completed in this study, (2) the cultural practices associated with vinclozolin use were not adequately described (i.e., the selection of canola and the application technique (aerial) for the test system were not adequately justified because the aerial application exposures have been shown to have significantly lower levels than open cab groundboom applications which are also allowed by the label), (3) no adequate pharmacokinetic data were provided to support the biological monitoring phase of the study, (4) the analytical quality control regimen in this study is inadequate (i.e., an insufficient number of field and laboratory recovery samples were generated), and (5) the field phase quality control regimen was inadequate (e.g., no provisions were apparently made regarding decontamination of the test subjects after each replicate during each test). Several other minor inadequacies/inconsistencies also exist in the study report which require further clarification.

Short-term and intermediate-term exposure assessments using PHED V1.1 data (chemical-specific data are pooled with the PHED data) are presented in Table 2. Tables 3 and 4 present the corresponding risk assessment for short-term exposures, while Tables 5 and 6 present the corresponding risk assessment for intermediate-term exposures. Table 7

summarizes the caveats and parameters specific to each exposure scenario and corresponding risk assessment.

Daily exposure is calculated using the following formula:

Daily Exposure (mg ai/day) □

- Area treated by each scenario. The treatment area ranged from 350 (agricultural crops) to 1,200 (forests) acres for aerial application, and 80 acres for groundboom, and 40 acres for airblast applications. In the case of low pressure handwand and backpack sprayers, 5 gallons were treated by homeowners while 40 gallons were treated by commercial applicators.

These calculations of daily exposure to vinclozolin by handlers are used to calculate the daily dose to those handlers.

groundboom, and 40 acres for airblast applications. In the case of low pressure handwand and backpack sprayers, 5 gallons were treated by homeowners while 40 gallons were treated by commercial applicators.

- The exposure scenario for "forest" using airblast equipment is a reasonable worse-case surrogate for treatment woody ornamentals using either airblast or groundboom equipment. The maximum application rate for woody ornamentals is the same as for "forest." Since the handler exposures from airblast application are higher than for groundboom application, the airblast scenario also serves to estimate groundboom exposures.

NOTE: Use of vinclozolin for wide-area treatment of forests is assumed. If the forestry use scenario is confirmed, use directions on vinclozolin labeling must be amended to more clearly instruct users about application rates for this use.

These calculations of daily dose to vinclozolin by handlers are used to assess the risk to those handlers.

The following equation is for determining the risk (MOE) from short-term and intermediate-term exposures.

$$\text{MOE} = \frac{\text{NOEL}}{\text{Daily Dermal Dose}}$$

Short-term Exposures

Tables 3 and 5 outline the exposures and corresponding MOEs for the short-term scenarios. The calculations using PHED data (data from MRID Nos. 424831-01 and 423424-01 were pooled with the available PHED data) indicate that the MOEs for short-term exposures at baseline protection (long-sleeve shirt, long pants, shoes, and socks) are over 100 for the following scenarios:

(1a) mixing/loading dry flowable for aerial application (for crops only);

(1b) mixing/loading dry flowable for groundboom application;

(1c) mixing/loading dry flowable for airblast application;

(4) applying spray with fixed-wing aircraft (for crops only);

(6) applying spray with groundboom equipment;

(8) applying spray with airblast equipment (for crops only);

(9) flagging for a spray applications by fixed- wing and rotary-wing aircraft (for turf and crops only);

(10) mixing/loading/applying with backpack sprayer equipment; and

(11) mixing/loading/applying with low-pressure handwand equipment.

The calculations indicate that the MOEs for short-term exposures with additional PPE are over 100 for the following scenarios:

(2b) mixing/loading wettable powder for groundboom application (for crops only) (PPE = double-layer body protection, chemical resistant gloves, and a dust/mist respirator);

(2c) mixing/loading wettable powder for airblast sprayer application (PPE = double-layer body protection, chemical resistant gloves, and a dust/mist respirator);

(3a) mixing/loading liquid flowable concentrate for aerial application (for crops only) - (PPE = double-layer body protection and chemical resistant gloves);

(3b) mixing/loading liquid flowable concentrate for groundboom application (PPE = double-layer body protection and chemical resistant gloves);

(3c) mixing/loading liquid flowable concentrate for airblast sprayer application (PPE = double-layer body protection and chemical resistant gloves);

(8) applying spray with airblast equipment (for forest only) - (PPE = double-layer body protection and chemical resistant gloves); and,

(9) flagging for spray applications by fixed-wing and rotary-wing aircraft (for forest only) - (PPE = double-layer body protection).

The calculations indicate that the MOEs for short-term exposures with engineering controls are over 100 for the following scenarios:

(2a) mixing/loading wettable powder for aerial application (for crops only) - (Engineering Controls = water-soluble packet and baseline protection);

(2b) mixing/loading wettable powder for groundboom application (for turf only) - (Engineering Controls = worker-soluble packet and baseline protection);

(3a) mixing/loading liquid flowable concentrate for aerial application (for turf and forest only) - (Engineering Controls = closed system and baseline protection);

(4) applying spray with fixed-wing aircraft (for turf and forest only) - (Engineering Controls = enclosed cockpit and baseline protection), and

(5) applying spray with rotary-wing aircraft (Engineering Controls = enclosed cockpit and baseline protection).

The calculations indicate that the MOEs for short-term exposures are not over 100 despite the maximum mitigation measures considered for the following scenarios:

(1a) mixing/loading dry flowables for aerial application (for turf and forest only) (no engineering controls identified); and,

(2a) mixing/loading wettable powder for aerial application (for turf and forest only) - (Engineering Controls = water-soluble packets and baseline protection). **Note**: MOEs are greater than 100 when area is 315 acres for turf and 400 acres for forest.

No data exist for the following scenarios:

(3d) mixing/loading liquid flowable concentrate for fogger application;

(5) applying spray with rotary-wing aircraft (no baseline protection or PPE data; however data are available for engineering controls -- enclosed cockpit);

(7) applying spray with a fogger;

(12) mixing/loading/applying with high-pressure equipment; and,

(13) mixing/loading/applying as a dip treatment.

Intermediate-term Exposures

Tables 4 and 6 outline the exposures and corresponding MOEs for the intermediate-term scenarios. The calculations using PHED data (data from MRID Nos. 424831-01 and 423424-01 were pooled with the available PHED data) indicate that the MOEs for intermediate-term exposures at baseline protection (long-sleeve shirt, long pants, shoes, and socks) are over 100 for the following scenarios:

(1c) mixing/loading dry flowable for airblast applications (for crops only);

(6) applying spray with groundboom equipment (crops only);

(10) mixing/loading/applying spray with backpack equipment.

The calculations indicate that the MOEs for intermediate-term exposures with additional PPE are over 100 for the following scenarios:

(3b) mixing/loading liquid flowable concentrate for groundboom application (for crops only) (PPE = double-layer body protection and chemical resistant gloves);

(3c) mixing/loading liquid flowable concentrate for airblast sprayer application (for crops only) (PPE = double-layer body protection and chemical resistant gloves);

(6) applying spray with groundboom equipment (for turf only) (PPE = double-layer body protection and chemical resistant gloves);

(9) flagging for spray applications (for crops only) (PPE= double-layer body protection); and,

(11) mixing/loading/applying with a low-pressure handwand (PPE for occupational handlers = double-layer body protection and chemical resistant gloves).

The calculations indicate that the MOEs for intermediate-term exposures with engineering controls are over 100 for the following scenarios:

(2b) mixing/loading wettable powder for groundboom application (for turf only) (Engineering Controls = water soluble packets and baseline protection);

(2c) mixing/loading wettable powder for airblast sprayer application (for crops only) (Engineering Controls = water soluble packets and baseline protection);

(3a) mixing/loading liquid flowable concentrate for aerial application (for crops only) - (Engineering Controls = closed system and baseline protection);

(4) application of spray by a fixed-wing aircraft (crops only) - (engineering controls = enclosed cockpit and baseline protection);

(5) application of spray by rotary-wing aircraft (for forest and crops only) - (engineering controls = enclosed cockpit and baseline protection);

(6) application of spray by a groundboom sprayer (for turf only) - (engineering controls = enclosed cockpit and baseline protection);

(8) application of spray using airblast equipment (engineering controls = enclosed cab and baseline protection); and

(9) flagging for spray from aerial application (for turf and forest only) (engineering controls = enclosed cab and baseline protection).

The calculations indicate that the MOEs for intermediate-term exposures are not over 100 despite the maximum mitigation measures considers for the following scenarios:

(1a) mixing/loading dry flowables for aerial application (no engineering controls identified);

(1b) mixing/loading dry flowables for groundboom application (no engineering controls identified);

(2a) mixing/loading wettable powder for aerial application (engineering controls = water-soluble packets and baseline protection). **Note**: MOEs are greater than 100 when mixing/loading for up to 25 acres for turf, 35 acres for forests, and 140 acres for crops.

(2b) mixing/loading wettable powder for groundboom application (turf only) (engineering controls = water soluble packets and baseline protection). **Note**: MOEs are greater than 100 when mixing/loading for up to 25 acres).

(2c) mixing/loading wettable powder for airblast sprayer applications (for turf only) (engineering controls = water soluble packets and baseline protection). **Note**: MOEs are greater than 100 when mixing/loading for up to 35 acres.

(3a) mixing/loading liquid flowable concentrate for aerial application (for turf/forest only) - (engineering controls =closed system and baseline protection). **Note**: MOEs are greater than 100 when mixing/loading for up to 70 acres for turf and 100 acres for forests.

(3b) mixing/loading liquid flowable concentrate for groundboom application (for turf only) - (engineering controls = closed system and baseline protection). **Note**: MOEs are greater than 100 when mixing/loading for up to 68 acres.

(4) application of spray by fixed-wing aircraft (turf and forest only) - (engineering controls = enclosed cockpit and baseline protection). **Note**: MOEs are greater than 100 when applying to up to 70 acres for turf and 100 acres for forests.

(5) application of spray by rotary-wing aircraft (for turf only) - (engineering controls = enclosed cockpit and baseline protection). **Note**: MOEs are greater than 100 when applying to up to 225 acres for turf.

No data exist for the following scenarios:

(1a) mixing/loading dry flowables for aerial application (no engineering controls identified);

(1b) mixing/loading dry flowables for groundboom application (no engineering controls identified);

(3d) mixing/loading liquid flowable concentrate for fogger application;

(5) applying spray with a rotary-wing aircraft (no data for baseline protection or additional PPE scenario, however data available for engineering control scenario;);

(7) applying spray with a fogger;

(12) mixing/loading/applying with a high-pressure handwand; and,

(13) mixing/loading/applying for a dip treatment.

Summary of Risks From Handler Exposures

Summary of Risks to Homeowner Handlers

The MOE's for homeowner handlers were greater than 100 for both the low-pressure hand-held sprayer and backpack sprayer assuming long-sleeve shirt, long pants, shoes and socks are worn. All homeowner handlers were assumed to be unlikely to be exposed seven days or more in a three-month period and, therefore, the short-term endpoint is used in determining the MOE's. The application rate for homeowners was assumed to be five gallons of dilute spray per day.

Summary of Risks to Occupational Handlers

The results of the risk assessment for occupational handlers indicate that:

- For wettable powder formulations, the only uses for which the MOEs are greater than 100 for all aspects (mixing, loading, and applying) of the application scenario are: (1) airblast applications to crops (with use of water-soluble packets for mixers/loaders and enclosed cabs for applicators); (2) groundboom applications to crops with use of water-soluble packets for mixers/loaders and baseline protection for applicators; (3) low-pressure handwand sprayer applications to crops with additional personal protective equipment for mixers, loaders, and applicators; and (4) backpack applications to crops with baseline protection for mixers, loaders, and applicators.

- For dry flowable formulations, the only uses for which the MOEs are greater than 100 for all aspects (mixing, loading, and applying) of the application scenario are: (1) airblast applications to crops with baseline protection for mixers/loaders and enclosed cabs for applicators; (2) low-pressure handwand sprayer applications to crops with additional personal protective equipment for mixers, loaders, and applicators; and (3) backpack applications to crops with baseline protection for mixers, loaders, and

applicators. If water-soluble packaging is used, it is likely that MOEs for groundboom applications to crops would also exceed 100 with water-soluble packets for mixers/loaders and baseline protection for applicators.

- For liquid flowable-concentrate formulations, the only uses for which the MOEs are greater than 100 for all aspects (mixing, loading, and applying) of the application scenario are: (1) airblast applications to crops with additional personal protective equipment for mixers and loaders and enclosed cabs for applicators; (2) airblast applications to forests with closed systems for mixers and loaders and enclosed cabs for applicators; (3) groundboom applications to crops with additional personal protective equipment for mixers and loaders and baseline protection for applicators; (4) aerial applications (fixed-wing and rotary-wing) to crops with closed systems for mixers and loaders, enclosed cockpits for applicators, and additional personal protective equipment for flaggers; (5) rotary-wing applications to turf and forests with closed systems for mixers and loaders, enclosed cockpits for applicators, and additional personal protective equipment for flaggers; (6) low-pressure handwand sprayer applications to crops with additional personal protective equipment for mixers, loaders, and applicators; and (7) backpack applications to crops with baseline protection for mixers, loaders, and applicators.

Risk From Postapplication Exposures

Postapplication occupational exposures may be mitigated for commercial production of food, turf, and ornamental crops by the establishment of restricted entry intervals (REIs). REIs allow sufficient time to pass for field residues to dissipate levels that result in MOEs greater than 100 for entering workers who contact treated surfaces. For postapplication homeowner exposures and occupational exposures to turf and ornamental plants in settings, such as landscape plantings and parks, restricted-entry intervals are generally infeasible.

Restricted-entry intervals (REIs) for this RED are derived using two methods. The first method uses data from vinclozolin-specific postapplication studies. The REIs for peaches orchards, strawberries, and residential turf are derived directly from vinclozolin-specific studies. The second method has been used when no vinclozolin-specific postapplication data are available. In these cases, the REIs are determined by using surrogate FDR data from the vinclozolin-specific postapplication studies and estimated transfer coefficents. Transfer coefficients are estimated for snap beans, cut-flowers, woody ornamentals, golf-course turf, and sod-farm turf.

Postapplication/reentry exposure and risk is calculated as follows:

$$\text{Daily Dose (mg/kg/day)} \square \frac{\text{Exposure (mg/day)}}{\text{Body Weight (60 kg)}}$$

— NOEL (1,2 for intermediate□term)

Three dissipation and reentry studies were submitted for peach orchards. The sites studied were in California, Georgia and Pennsylvania. Table 8 summarize the "Best Fit" FDR data, dermal exposure values, doses and MOEs for the harvesters monitored in these studies. Table 8 also extrapolates the transfer coefficient from study 3 to the Georgia site in

Study 1. For the intermediate-term exposures, the MOEs were above 100 at 9 days after application for the California site, 13 days after application for the Pennsylvania site, and at 6 days after application for the Georgia site. The average MOE (based on the average FDR data) is 9 days.

OCCUPATIONAL STRAWBERRIES:

Three dissipation and reentry studies were submitted for strawberries. The sites studied were in California (2 sites) and Michigan. These data were used to calculate both the occupational restricted-entry intervals as well as the residential restricted-entry interval (see below). Table 9 summarizes the "Best Fit" FDR data, dermal exposure values, doses, and MOEs for the harvesters monitored in these studies. For the intermediate-term exposures, the MOEs were above 100 at 16 days after application at the Madera, California site, at 6 days after application for the Fallbrook, California site, and at 2 days after application for the Conkin, Michigan site. The average MOE (based on the average FDR data) is 8 days.

RESIDENTIAL STRAWBERRIES:

In addition to the intermediate-term based occupational REI, a short-term based residential REI was calculated for harvesters. This residential REI is based on the short-term NOEL (60 mg/kg) and only one hour of reentry.

Table 10: Residential Entry Intervals for Strawberries.

DAT	Best Fit FDR (ug/cm^2)[a]	Exposure (mg/day)[b]	Dose (mg/kg/day)[c]	MOE[d]
0	1.1167	0.84	0.014	4,286

[a] The average foliar dislodgeable residues from the three strawberry studies discussed above.
[b] Exposure (mg/day) = [(Best Fit FDR x Transfer Coefficient (749 cm^2/hr))/1000] x 1 hr.
[c] Dose = (mg/kg/day) = Exposure/60 kg.
[d] MOE = NOEL (60 for short-term)/Dose

The MOE exceeds 100 on the day of application after sprays have dried.

RESIDENTIAL TURF:

Three dissipation and reentry studies were submitted for residential turf. The sites studied were in California, Florida, and Pennsylvania. The transfer coefficient derived from the actual dissipation data in study 9 was 8,547 cm^2/hr while, the transfer coefficient using the Best Fit FDR was 17,666 cm^2/hr. In Table 11, the 8,547 cm^2/hr transfer coefficient was used. For the intermediate-term exposures, the Florida site reached an MOE of 100 at 11 days following application; the California site reached an MOE of 100 at 34 days following application, the Pennsylvania site reached an MOE of 100 at 43 days following application. The average MOE (based on average FDR data) reached 100 at 37 days following application.

Surrogate Postapplication Data and Derived REIs

SNAP BEANS

Table 12 presents the MOEs for snap beans ranging from the day of application after sprays have dried to ten days after application when the MOE reached 100. The transfer coefficient (Tc) was estimated by OREB based on the reasonable worse-case activity of hand-harvesting snap beans. The strawberry studies (MRID Nos. 430130-03, 430130-04 and 430130-05) were chosen by EPA as the best available surrogate FDR data for snap beans.

Table 12: Restricted-Entry Interval for Snap beans

Crops	Tc (cm^2/hr)	REI	
		MOE DAT 0	MOE ≥ 100
Snap Beans	1,000[a]	30	10 DAT

[a] Tc of 1,000 (cm^2/hr) is based on OREB's best estimate for hand harvesting snap beans and was used with to the vinclozolin-specific FDR data for strawberries. (MRID Nos. 430130-03, 04, and 05)

FLOWERS

Table 13 presents the MOEs for flowers and ornamental-foliage plants ranging from the day of application after sprays have dried to 36 days after application when the MOE reached 100. The transfer coefficient (Tc) was estimated by OREB based on the reasonable worse-case task of hand-harvesting and hand-bundling cut flowers and cut foliage. The strawberry studies (MRID Nos. 430130-03, 430130-04 and 430130-05) were chosen by EPA as the best available surrogate FDR data for flowers and ornamental-foliage plants.

Table 13: Restricted-Entry Interval for Flowers

Crops	Tc (cm^2/hr)	REI	
		MOE DAT 0	MOE ≥ 100
Flowers	10,000[a]	3	36 DAT

[a] Tc of 10,000 (cm^2/hr) is based on OREB's best estimate and was used with chemical-specific FDR data for strawberries. (MRID No. 430130-03, 04, and 05)

WOODY ORNAMENTALS

Table 14 presents the MOEs for woody ornamentals ranging from the day of application after sprays have dried to 19 days after application when the MOE reached 100. The transfer coefficient (Tc) was estimated by OREB based on the reasonable worse-case tasks of harvesting/transplanting (ball and burlap) woody ornaments. The peach studies (MRID Nos. 428300-01, 435059-01 and 428300-02) were chosen by EPA as the best available surrogate FDR data for woody ornamentals. The peach tree FDR data represent an application rate of 1.0 lb ai/A. The rate for the woody ornamentals (EPA Reg. No. 58185-17) is 1.0 lb product (50 percent ai) per 100 gallons of water applied at 6 gallons of spray per 1,000 ft^2 (or 1.3 lb ai/A). No adjustment (i.e., normalization) was made to the peach FDR data in these REI calculations.

Table 14: Restricted-Entry Intervals for Woody Ornamentals

Crops	Tc (cm^2/hr)	REI	
		MOE DAT 0	MOE ≥ 100
Ornamentals (Woody)	10,000[a]	6	19 DAT

[a] Tc of 10,000 (cm^2/hr) is based on OREB's best estimate and was used with vinclozolin-specific FDR data for peaches. (MRID Nos. 428300-01 and 435059-01)

GOLF COURSE TURF:

Table 15 presents the MOEs for golf course workers ranging from the day of application after sprays have dried to 16 days after application when the MOE reached 100. The transfer coefficient (Tc) was estimated by OREB based on the reasonable worse-case tasks of routine golf-course turf maintenance. The vinclozolin-specific residential turf studies (MRID Nos. 535287-01, 433437-01 and 433437-02) were used for the turf FDR data. EPA notes that these estimates are based on broadcast applications to the greens, fairways, and roughs. If applications are limited to spot-treatments or to greens only, the estimated exposures would be substantially lower.

Table 15: Restricted-Entry Intervals for Golf Courses

Crops	Tc (cm^2/hr)	REI	
		MOE DAT 0	MOE ≥ 100
Golf Course	500[a]	10	16 DAT

[a] Tc of 500 (cm^2/hr) is based on OREB's best estimate and was used with vinclozolin-specific FDR data for turf. (MRID Nos. 433437-01 and 435287-01)

SOD FARM TURF:

Table 16 presents the MOEs for sod farm workers ranging from the day of application after sprays have dried to 42 days after application when the MOE reached 100. The transfer coefficient (Tc) was estimated by OREB based on the reasonable worse-case tasks of harvesting sod. The vinclozolin-specific residential turf studies (MRID Nos. 535287-01, 433437-01 and 433437-02) were used for the turf FDR data.

Table 16: Restricted-Entry Intervals for Sod Farms

Crops	Tc (cm^2/hr)	REI	
		MOE DAT 0	MOE ≥ 100
Sod Farm	17,666[a]	0.3	42 DAT

[a] Tc of 17,666 (cm^2/hr) is based on best-fit data for turf and was applied to vinclozolin-specific FDR data for turf. (MRID Nos. 433437-01 and 43528-01).

Summary of Risks From Postapplication Exposures

Summary of Risks From Postapplication Exposures to Homeowners

- The MOEs for homeowners were greater than 100 for the strawberry use on the day of application, after sprays had dried. The strawberry data are considered a reasonable worse-case exposure scenario for homeowner uses on other types of garden food crops and ornamental (other than turf) plantings.

- The MOEs for homeowners were greater than 100 for the turf use on average at 37 days after application. These results are based on typical recreational activities on lawns.

Summary of Risks From Postapplication Exposures to Occupational Workers

The restricted-entry interval is established, in general, based upon the number of days following application that must elapse before the MOEs for occupational workers exceed 100. When more than one use-site was used to gather postapplication exposure data, the average number of days following application when the MOE exceed 100 was estimated among the sites. The average is based on the average FDR data, not an average of MOEs at the various use-sites. EPA has estimated that under the present assumptions and use-rates, the following restricted-entry intervals would apply for occupational exposures to vinclozolin:

- Peaches (and other similar crop groupings such as apricots, cherries, nectarines, and prunes) would have an REI of at least 9 days;

- Strawberries (and other similar crop groupings such as lettuce and onions) would have an REI of at least 7 days;

- Snap beans (and other similar crop groupings such as chicories and raspberries (black and red)) would have an REI of 10 days;

- Cut-flower, cut-foliage, and other herbaceous ornamentals (closest surrogate to represent kiwi) would have an REI of at least 36 days;

- Woody ornamentals would have an REI of at least 19 days;

- Turf on golf courses would have an entry restriction posed on maintenance workers of at least 16 days. [EPA notes that these estimates are based on broadcast applications to the greens, fairways, and roughs. If applications are limited to spot-treatments or to greens only, the estimated entry restriction would be substantially less]; and

- Turf on sod farms would have an REI of at least 42 days.

(SECTION IV - REGULATORY POSITION AND LABELING RATIONALE)

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(RED SECTION V - LABELING REQUIREMENTS)

DUE TO THE NUMEROUS RISK CONCERNS AND UNRESOLVED ISSUES FOR BOTH HANDLERS AND POSTAPPLICATION OCCUPATIONAL WORKERS, OREB IS REQUESTING A MEETING WITH THE REGISTRANT AND POSTPONING COMPLETION OF THESE APPENDICES TO THEIR RED CHAPTER UNTIL APPROPRIATE RISK-MITIGATION MEASURES HAVE BEEN DETERMINED.

References:

1) Vinclozolin labels.

2) U.S. EPA 1995. LUIS Report for Vinclozolin, Dated 4/6/95.

3) U.S. EPA 1995. Toxicology Endpoint Selection Document, Dated 11/21/95.

Registrant Submitted Studies

Dissipation of Dislodgeable Foliar Residues of Vinclozolin (Ronilan® DF Fungicide) Applied to Orchards California and Georgia Sites. MRID No. 428300-01.

Dissipation of Dislodgeable Foliar Residue of Vinclozolin (Ronilan® DF Fungicide) Applied to Orchards: Pennsylvania Site (one of three sites). MRID No. 435059-01.

Worker Re-entry Exposure While Harvesting Stone Fruit Treated with Ronilan® DF Fungicide in California. MRID No. 428300-02.

Worker Re-entry Exposure While Harvesting Strawberries Treated with Ronilan® DF Fungicide in California - MRID No. 430130-03.

Dissipation of Dislodgeable Foliar Residues of Vinclozolin (Ronilan® DF Fungicide) Applied to Strawberry. MRID No. 430130-04.

Dissipation of Dislodgeable Soil Residues of Vinclozolin (Ronilan® DF Fungicide) Applied to Strawberry. MRID No. 430130-05.

Worker Mixer/Loader Applicator Exposure to Ronilan DF (PHED Study No. 1002), MRID No. 424831-01.

Worker Mixer/Loader Applicator Exposure to Ronalin WP (PHED Study No. 1000), MRID No. 423424-01.

FDR of Vinclozolin (Ronalin® DF) in Turf, Florida Site. MRID No. 435287-01.

FDR of Vinclozolin (Ronalin® DF) in Turf, California and Pennsylvania Sites. MRID No. 433437-01.

Evaluation of Turf Reenty Exposure in California to a Broadcast Application of Ronalin® DF. MRID No. 433437-02.

Table 2. Short-Term and Intermediate-Term Exposure of Vinclozolin

Exposure Scenario (Scen. #)	Baseline Dermal Unit Exposure[a] (mg/lb ai)	Baseline Inhalation Unit Exposure[b] (μg/lb ai)	Application Rate[c] (lb ai/acre)	Daily Acres Treated[d]	Daily Dermal Exposure[e] (mg/day)	Daily Inhalation Exposure[f] (mg/day)	Daily Total Exposure[g] (mg/day)
Mixer/Loader Exposure							
Mixing/Loading Dry Flowables for Aerial Applications Systems (1a)	0.07	0.8	Turf = 5.5 Forest = 4.0 Crop = 1.0	500 1,200 350	192.5 336 24.5	2.2 3.8 0.3	194.7 339.8 24.8
Mixing/Loading Dry Flowables for Groundboom Application (1b)			Crop = 1.0 Turf = 5.5	80	5.6 30.8	0.064 0.352	5.7 31.2
Mixing/Loading Dry Flowables for Airblast Sprayer Application (1c)			Crop = 1.0 Forest = 4.0	40	2.8 11.2	0.03 0.128	2.8 11.3
Mixing/Loading Wettable Powder for Aerial Applications and Sprinkler Irrigation Systems (2a)	3.8	43.4	Turf = 5.5 Forest = 4.0 Crop = 1.0	500 1,200 350	10,450 18,240 1,330	119.4 208.3 15.2	10,569 18,448 1,345
Mixing/Loading Wettable Powder for Groundboom Applications (2b)			Crop = 1.0 Turf = 5.5	80	304 1,672	3.5 19.1	307.5 1,691.1
Mixing/Loading Wettable Powder for Airblast Sprayer Application (2c)			Crop = 1.0 Forest = 4.0	40	152 608	1.7 6.9	153.7 614.9
Mixing/Loading Liquid (Flowable Conc.) for Aerial Application and Sprinkler Irrigation Systems (3a)	2.9	1.2	Turf = 5.5 Forest = 4.0 Crop = 1.0	500 1,200 350	7,975 13,920 1,015	3.3 5.8 0.4	7,978 13,926 1,015
Mixing/Loading Liquid (Flowable Conc.) for Groundboom Applications (3b)			Crop = 1.0 Turf = 5.5	80	232 1,276	0.1 0.53	232.1 1,276.5
Mixing/Loading Liquid (Flowable Conc.) for Airblast Sprayer Application (3c)			Crop = 1.0 Forest = 4.0	40	116 464	0.05 0.19	116 464.2
Mixing/Loading Liquid (Flowable Conc.) for Fogger (3d)	No data	No data	No data	No data	No data	No data	No data
Applicator Exposure							
Aerial-Fixed Wing (liquid) (4)	0.049	0.27	Turf = 5.5 Forest = 4.0 Crop = 1.0	500 1,200 350	134.8 235.2 17.2	0.74 1.3 0.09	135.5 236.5 17.3
Aerial-Helicopter (liquid) (5)	No data (see Engineering Controls)	No data (see Engineering Controls)	No data (see Engineering Controls)	No data (see Engineering Controls)	No data (see Engineering Controls)	No data (see Engineering Controls)	No data (see Engineering Controls)
Groundboom Tractor (6)	0.015	0.7	Crop = 1.0 Turf = 5.5	80	1.2 6.6	0.06 0.33	1.3 6.9
Fogging (7)	No Data	No Data	No Data	No Data	No Data	No Data	No Data
Airblast Sprayer (8)	0.4	4.5	Forest = 4.0 Crop = 1.0	40	64 16	0.72 0.18	64.7 16.2

Exposure Scenario (Scen. #)	Baseline Dermal Unit Exposure[a] (mg/lb ai)	Baseline Inhalation Unit Exposure[b] (μg/lb ai)	Application Rate[c] (lb ai/acre)	Daily Acres Treated[d]	Daily Dermal Exposure[e] (mg/day)	Daily Inhalation Exposure[f] (mg/day)	Daily Total Exposure[g] (mg/day)
Flagger							
Flagging (liquid) (9)	0.01	0.3	Turf = 5.5 Forest = 4.0 Crop = 1.0	500 1,200 350	27.5 48 3.5	0.83 1.44 0.11	28.3 49.4 3.6
Mixer/Loader/Applicator							
Backpack (10)	2.6	30	Greenhouse/ ornamentals 0.0075 lb ai/gal.	5 gal (H) 40 gal (O)	0.098 (H) 0.78 (O)	0.001 (H) 0.009 (O)	0.099 (H) 0.79 (O)
Low Pressure Handwand (11)	103	31	Greenhouse/ ornamentals 0.0075 lb ai/gal.	5 gal (H) 40 gal (O)	3.9 (H) 30.9 (O)	0.001 (H) 0.009 (O)	3.9 (H) 30.9 (O)
			Turf = 5.5	1,000 ft^2	13.0	0.0039	13.0
High Pressure Handwand (12)	No data	No data	No data	No data	No data	No data	No data
Dip Treatment (13)	No data	No data	No data	No data	No data	No data	No data

[a] Baseline dermal unit exposures represent long pants, long sleeve shirts, no gloves, open mixing/loading, open cockpit, open cab tractor.

[b] Baseline inhalation unit exposure represents no respirator.

[c] Application rates 5.5 lb ai/acre represents turf, 4.0 lb ai/acre represents forest, 1.0 lb ai/acre represents crop rates.

[d] Values represent the area or the volume of spray solution [(H) = homeowner, (O) = occupational] which can be used in a single day to complete treatments for each exposure scenario of concern. For aerial application the following assumptions were used: for turf treatment 500 acres was used, for forest/ornamentals 1200 acres was used and for crops 350 acres were used.

[e] Daily dermal exposure (mg/day) = Exposure (mg/lb ai) * Max. Appl. Rate (lb ai/acre or lb ai/gal) * Max. Treated (acres or gallons of spray solution).

[f] Daily inhalation exposure (mg/day) = Exposure (ug/lb ai) * (1mg/1000ug) conversion * Max Appl Rate (lb ai/A or lb ai/gal) * Max Treated (acres or gallons of spray solution).

[g] Daily total exposure (mg/day) = Daily dermal exposure + Daily inhalation exposure.

Table 3: Short-Term Risk of Vinclozolin

Exposure Scenario (Scen. #)	Baseline Daily Dermal Dose (mg/kg/day)[a]	Baseline Total Dose (mg/kg/day)[b]	Baseline Dermal MOE[c]	Baseline Total MOE[d]	Risk Mitigation Measure: Additional PPE[e] — Dermal Unit Exposure (mg/lb ai)*	Inhalation Unit Exposure (ug/lb ai)*	Daily Dermal Dose (mg/kg/day)[a]	Daily Total Dose (mg/kg/day)[b]	Dermal MOE[c]	Total MOE[d]
Mixer/Loader Risk										
Mixing/Loading Dry Flowables for Aerial Applications and Sprinkler Irrigation Systems (1a)	Turf = 3.2 Forest = 5.6 Crop = 0.4	3.2 5.7 0.4	19 11 150	19 11 150	0.04	0.08 (no respirator)	1.8 3.2 N/A	1.8 3.3 N/A	33 19 N/A	33 18 N/A
Mixing/Loading Dry Flowables for Groundboom Applications (1b)	Crop = 0.09 Turn = 0.51	0.1 0.52	667 118	600 115			N/A N/A	N/A N/A	N/A N/A	N/A N/A
Mixing/Loading Dry Flowables for Airblast Sprayer Application (1c)	Crop = 0.05 Forest = 0.19	0.05 0.19	1,200 316	1,200 316			N/A N/A	N/A N/A	N/A N/A	N/A N/A
Mixing/Loading Wettable Powder for Aerial Applications and Sprinkler Irrigation Systems (2a)	Turf = 174.2 Forest = 304 Crop = 22.2	176.2 307.5 22.4	0.3 0.2 3	0.3 0.2 3	0.1	8.7 (dust/ mist respirator)	4.6 8 0.58	4.9 8.7 0.63	13 8 103	2 7 95
Mixing/Loading Wettable Powder for Groundboom Applications (2b)	Crop = 5.1 Turf = 27.9	5.1 28.2	12 2	12 2			0.13 0.73	0.14 0.79	462 82	429 76
Mixing/Loading Wettable Powder for Airblast Sprayer Application (2c)	Crop = 2.5 Forest = 10.1	2.6 10.2	24 6	23 6			0.07 0.27	0.08 0.29	857 222	750 207
Mixing/Loading Liquid (Flowable Conc.) for Aerial Applications and Sprinkler Irrigation Systems (3a)	Turf = 132.9 Forest = 232 Crop = 6.9	133 232.1 16.9	0.5 0.3 4	0.5 0.3 4	0.024	1.2 (no respirator)	1.1 1.9 0.14	1.2 2.0 0.15	55 32 429	50 30 400
Mixing/Loading Liquid (Flowable Conc.) for Groundboom Applications (3b)	Crop = 3.9 Turf = 21.3	3.9 21.3	15 3	15 3			0.03 0.18	0.03 0.19	2,000 333	2,000 316
Mixing/Loading Liquid (Flowable Conc.) for Airblast Sprayer Applications (3c)	Crop = 1.9 Forest = 7.7	1.9 7.7	32 8	32 8			0.016 0.064	0.016 0.067	3,750 938	3,750 896
Mixing/Loading Liquid (Flowable Conc.) for Fogger Applications (3d)	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data
Applicator Risk										
Aerial-Fixed Wing (liquid) (4)	Turf = 2.2 Forest = 3.9 Crop = 0.29	2.3 3.9 0.29	26 15 206	27 15 206	0.039 (no gloves)	0.27	1.8 3.1 N/A	1.8 3.1 N/A	33 19 N/A	33 19 N/A
Aerial-Helicopter (liquid) (5)	No data (see Engineering Controls)	No data (see Engineering Controls)	No data (see Engineering Controls)	No data (see Engineering Controls)	No data (see Engineering Controls)	No data (see Engineering Controls)	No data (see Engineering Controls)	No data (see Engineering Controls)	No data (see Engineering Controls)	No data (see Engineering Controls)
Groundboom Tractor (6)	Crop = 0.02 Turf = 0.11	0.02 0.12	3,000 545	3,000 500	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A
Fogging (7)	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
Airblast Sprayer (8)	Forest = 1.1 Crop = 0.27	1.1 0.27	55 222	55 222	0.1	4.5 (no respirator)	0.27 N/A	0.28 N/A	222 N/A	214 N/A
Flagger Risk										

Exposure Scenario (Scen. #)	Baseline Daily Dermal Dose (mg/kg/day)[a]	Baseline Total Dose (mg/kg/day)[b]	Baseline Dermal MOE[c]	Baseline Total MOE[d]	Risk Mitigation Measure					
					Additional PPE[e]					
					Dermal Unit Exposure (mg/lb ai)*	Inhalation Unit Exposure (ug/lb ai)*	Daily Dermal Dose (mg/kg/day)[a]	Daily Total Dose (mg/kg/day)[b]	Dermal MOE[c]	Total MOE[d]
Flagging (liquid) (9)	Turf = 0.46 Forest = 0.8 Crop = 0.06	0.47 0.82 0.06	130 75 1,000	128 73 1,000	0.0038	0.3 (no respirator)	N/A 0.30 N/A	N/A 0.32 N/A	N/A 200 N/A	N/A 188 N/A
Mixer/Loader/Applicator										
Backpack Sprayer (10)	Greenhouse/ ornamentals 0.0016 (H) 0.013 (O)	0.0017 (H) 0.013 (O)	37,500 (H) 4,615 (O)	35,294 (H) 4,615 (O)	N/A	N/A	N/A	N/A	N/A	N/A
Low Pressure Handwand (11)	Greenhouse/ ornamentals 0.065 (H) 0.52 (O)	0.065 (H) 0.52 (O)	923 (H) 115 (O)	923 (H) 115 (O)	N/A	N/A	N/A	N/A	N/A	N/A
	Turf = 0.22	0.22	273	273	N/A	N/A	N/A	N/A	N/A	N/A
High Pressure Handwand (12)	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data
Dip Treatment (13)	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data

N/A Not applicable since previous MOE was over 100.

[a] Daily dermal dose = daily dermal exposure / 60 kg.
[b] Baseline Total Dose = (daily dermal exposure + daily inhalation exposure)/60 kg.
[c] Dermal MOE = NOEL (short-term NOEL = 60 mg/kg/day)/ daily dermal dose.
[d] Total MOE = NOEL (short-term NOEL = 60 mg/kg/day) / daily total dose.
[e] Maximum PPE for Scenario 1 = Coveralls over single layer clothing and chemical resistant gloves.
for Scenarios 2a and 2b = Coveralls over single layer clothing, chemical resistant gloves and dust/mist respirator.
for Scenarios 3a and 3b = Coveralls over single layer clothing and chemical resistant gloves.
for Scenario 4 = Coveralls over single layer of clothing.
for Scenario 8 = Coveralls over single layer clothing and chemical resistant gloves.
for Scenario 9 = Coveralls over single layer of clothing and chemical resistant gloves.
* Study data from MRID 423424-01 has been incorporated into these PHED values.
Respirators were only applied to situations with significant inhalation exposure (i.e. mixing/loading wettable powders).

Table 4: Intermediate-Term Risk of Vinclozolin

Exposure Scenario (Scen. #)	Baseline Daily Dermal Dose (mg/kg/day)[a]	Baseline Absorbed Dermal Dose (mg/kg/day)[b]	Baseline Total Absorbed Dose (mg/kg/day)[c]	Baseline Dermal MOE[d]	Baseline Total MOE[e]	Risk Mitigation Measure					
						Additional PPE[f]					
						Dermal Unit Exposure (mg/lb ai)*	Inhalation Unit Exposure (ug/lb ai)*	Daily Dermal Absorbed Dose (mg/kg/day)[b]	Daily Total Absorbed Dose (mg/kg/day)[c]	Dermal MOE[d]	Total MOE[e]
Mixer/Loader Risk											
Mixing/Loading Dry Flowables for Aerial Applications and Sprinkler Irrigation Systems (1a)	Turf = 3.2 Forest = 5.6 Crop = 0.4	0.81 1.41 0.1	0.85 1.47 0.1	2 0.9 12	1 0.8 12	0.04	0.08 (no respirator)	0.46 0.8 0.06	0.46 0.81 0.06	3 2 20	3 2 20
Mixing/Loading Dry Flowables for Groundboom Application (1b)	Crop = 0.09 Turf = 0.51	0.02 0.13	0.02 0.13	60 9	60 9			0.013 0.07	0.013 0.07	92 17	92 17
Mixing/Loading Dry Flowables for Airblast Sprayer Application (1c)	Crop = 0.05 Forest = 0.19	0.01 0.05	0.01 0.05	120 24	120 24			N/A 0.027	N/A 0.027	N/A 44	N/A 44
Mixing/Loading Wettable Powder for Aerial Applications and Sprinkler Irrigation Systems (2a)	Turf = 174.2 Forest = 304 Crop = 22.2	43.9 76.6 5.6	45.9 80.1 5.9	0.03 0.02 0.2	0.03 0.01 0.2	0.1	8.7 (dust/mist respirator)	1.2 2 0.15	1.6 2.7 0.2	1 0.6 8	0.8 0.4 6
Mixing/Loading Wettable Powder for Groundboom Applications (2b)	Crop = 5.1 Turf = 27.9	1.3 7.0	1.4 7.1	0.92 0.17	0.86 0.17			0.03 0.18	0.04 0.24	40 7	30 5
Mixing/Loading Wettable Powder for Airblast Sprayer Application (2c)	Crop = 2.5 Forest = 10.1	0.63 2.5	0.66 2.6	2 0.48	2 0.46			0.02 0.067	0.03 0.09	60 18	40 13
Mixing/Loading Liquid (Flowable Conc.) for Aerial Applications and Sprinkler Irrigation Systems (3a)	Turf = 132.9 Forest = 232 Crop = 16.9	33.5 58.5 4.3	33.6 58.6 4.3	0.03 0.02 0.28	0.04 0.02 0.28	0.024	1.2 (no respirator)	0.28 0.48 0.04	0.34 0.58 0.04	4 3 30	4 2 30
Mixing/Loading Liquid (Flowable Conc.) for Groundboom Applications (3b)	Crop = 3.9 Turf = 21.3	0.98 5.4	0.98 5.4	1.2 0.22	1.2 0.22			0.008 0.04	0.01 0.05	150 30	120 24
Mixing/Loading Liquid (Flowable Conc.) for Airblast Sprayer Application (3c)	Crop = 1.9 Forest = 7.7	0.48 1.9	0.48 1.9	2.5 0.63	2.5 0.63			0.004 0.016	0.005 0.019	300 75	240 63
Mixing/Loading Liquid (Flowable Conc.) for Fogger Application (3d)	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data

Exposure Scenario (Scen. #)	Baseline Daily Dermal Dose (mg/kg/day)[a]	Baseline Absorbed Dermal Dose (mg/kg/day)[b]	Baseline Total Absorbed Dose (mg/kg/day)[c]	Baseline Dermal MOE[d]	Baseline Total MOE[e]	Risk Mitigation Measure					
						Additional PPE[f]					
						Dermal Unit Exposure (mg/lb ai)*	Inhalation Unit Exposure (ug/lb ai)*	Daily Dermal Absorbed Dose (mg/kg/day)[b]	Daily Total Absorbed Dose (mg/kg/day)[c]	Dermal MOE[d]	Total MOE[e]
Applicator Risk											
Aerial-Fixed Wing (liquid) (4)	Turf = 2.2 Forest = 3.9 Crop = 0.29	0.55 0.98 0.07	0.56 1.0 0.07	2 1 17	2 1 17	0.039 (no gloves)	0.27	0.45 0.79 0.06	0.46 0.81 0.06	3 2 20	3 2 20
Aerial-Helicopter (liquid) (5)	No data (see Engineering Controls)	No data (see Engineering Controls)	No data (see Engineering Controls)	No data (see Engineering Controls)	No data (see Engineering Controls)	No data (see Engineering Controls)	No data (see Engineering Controls)	No data (see Engineering Controls)	No data (see Engineering Controls)	No data (see Engineering Controls)	No data (see Engineering Controls)
Groundboom Tractor (6)	Crop = 0.02 Turf = 0.11	0.005 0.027	0.006 0.03	600 44	200 40	N/A 0.01	N/A 0.07	N/A 0.018	N/A 0.024	N/A 67	N/A 50
Fogging (7)	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data
Airblast Sprayer (8)	Forest = 1.1 Crop = 0.27	0.28 0.07	0.29 0.07	4 17	4 17	0.1	4.5 (no respirator)	0.07 0.02	0.08 0.02	17 60	15 60
Flagger Risk											
Flagging (liquid) (9)	Turf = 0.46 Forest = 0.8 Crop = 0.06	0.12 0.2 0.02	0.13 0.2 0.05	10 6 60	9 6 24	0.0038	0.3 (no respirator)	0.04 0.08 0.006	0.05 0.10 0.008	30 15 200	24 12 150
Mixer/Loader/Applicator											
Backpack Sprayer (10)	Greenhouse/ ornamentals 0.013 (O)	0.003 (O)	0.003 (O)	400 (O)	400 (O)	N/A	N/A	N/A	N/A	N/A	N/A
Low Pressure Handwand (11)	Greenhouse/ ornamentals 0.52 (O)	0.13 (O)	0.13 (O)	9 (O)	9 (O)	4.1 (O)	3.2 (0) (no respirator)	0.005	0.005	240 (O)	240 (O)
High Pressure Handwand (12)	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data
Dip Treatment (13)	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data

N/A Not applicable since previous MOE was over 100.

[a] Daily dermal dose = daily dermal exposure/60 kg.

[b] Baseline absorbed dermal dose = daily dermal dose * dermal absorption rate 25.2 %.

[c] Baseline total dose = (daily absorbed dermal exposure + daily inhalation exposure)/60 kg.

[d] Dermal MOE = NOEL (intermediate-term NOEL = 1.2 mg/kg/day) / daily absorbed dermal dose.

[e] Total MOE = NOEL (intermediate-term NOEL = 1.2 mg/kg/day) / daily total dose.

[f] Additional PPE = for Scenario 1a = Coveralls over single layer of clothing and chemical resistant gloves.
for Scenario 2a = Coveralls over single layer of clothing, chemical resistant gloves and a dust/mist respirator.
for Scenario 2b = Coveralls over single layer of clothing and chemical resistant gloves.
for Scenarios 3a and 3b = Coveralls over single layer clothing and chemical resistant gloves.
for Scenario 8 = Single layer clothing and chemical resistant gloves.
for Scenario 9 = Coveralls over single layer of clothing.

* Study data from MRID # 423424-01 was incorporated into these PHED values.
Respirators were only applied to situations with significant inhalation exposure (i.e. mixing/loading wettable powders).

Table 5. Short-Term Risk of Vinclozolin (Engineering Controls)

Exposure Scenario (Scen. #)	Risk Mitigation Measure					
	Engineering Controls[c]					
	Dermal Unit Exposure (mg/lb ai)	Inhalation Unit Exposure (ug/lb ai)	Daily Dermal Dose (mg/kg/day)[a]	Daily Total Dose (mg/kg/day)[b]	Dermal MOE[c]	Total MOE[d]
Mixer/Loader Risk						
Mixing/Loading Dry Flowables for Aerial Applications and Sprinkler Irrigation Systems (1a)	None	None	None	None	None	None
Mixing/Loading Dry Flowables for Groundboom Applications (1b)	N/A	N/A	N/A	N/A	N/A	N/A
Mixing/Loading Dry Flowables for Airblast Sprayer Application (1c)	N/A	N/A	N/A	N/A	N/A	N/A
Mixing/Loading Wettable Powder for Aerial Applications and Sprinkler Irrigation Systems (2a)	0.02	0.2	Turf = 0.92 Forest = 1.6 Crop = 0.12	0.93 1.6 0.12	65 38 500	65 38 500
Mixing/Loading Wettable Powder for Groundboom Applications (2b)	0.02	0.2	Crops = N/A Turf = 0.15	N/A 0.15	N/A 400	N/A 400
Mixing/Loading Wettable Powder for Airblast Sprayer Application (2c)	N/A	N/A	N/A	N/A	N/A	N/A
Mixing/Loading Liquid (Flowable Conc.) for Aerial Applications and Sprinkler Irrigation Systems (3a)	0.007	0.08	Turf = 0.32 Forest = 0.56 Crop = N/A	0.32 0.56 N/A	188 107 N/A	188 107 N/A
Mixing/Loading Liquid (Flowable Conc.) for Groundboom Applications (3b)	N/A	N/A	N/A	N/A	N/A	N/A
Mixing/Loading Liquid (Flowable Conc.) for airblast Sprayer Application (3c)	N/A	N/A	N/A	N/A	N/A	N/A
Mixing/Loading Liquid (Flowable Conc.) for Fogger Applications (3d)	No data	No data	No data	No data	No data	No data
Applicator Risk						
Aerial-Fixed Wing (liquid) (4)	0.005	0.068	Turf = 0.23 Forest = 0.4 Crop = N/A	0.23 0.4 N/A	261 150 N/A	261 150 N/A
Aerial-Helicopter (liquid) (5)	0.002	0.002	Turf = 0.065 Forest = 0.047 Crop = 0.012	0.065 0.047 0.012	923 1,277 5,000	923 1,277 5,000
Groundboom Tractor (6)	N/A	N/A	N/A	N/A	N/A	N/A
Fogging (7)	No Data	No Data	No Data	No Data	No Data	No Data
Airblast Sprayer (8)	N/A	N/A	N/A	N/A	N/A	N/A
Flagger Risk						

Exposure Scenario (Scen. #)	Risk Mitigation Measure					
	Engineering Controls[e]					
	Dermal Unit Exposure (mg/lb ai)	Inhalation Unit Exposure (ug/lb ai)	Daily Dermal Dose (mg/kg/day)[a]	Daily Total Dose (mg/kg/day)[b]	Dermal MOE[c]	Total MOE[d]
Flagging (liquid) (9)	N/A	N/A	N/A	N/A	N/A	N/A
Mixer/Loader/Applicator						
Backpack Sprayer (10)	None	None	None	None	None	None
Low Pressure Handwand (11)	None	None	None	None	None	None
High Pressure Handwand (12)	No Data	No Data	No Data	No Data	No Data	No Data
Dip Treatment (13)	No Data	No Data	No Data	No Data	No Data	No Data

N/A Not applicable since previous MOE was over 100.
None Engineering controls not possible.
[a] Daily dermal dose = daily dermal exposure / 60 kg.
[b] Baseline Total Dose = (daily dermal exposure + daily inhalation exposure)/60 kg.
[c] Dermal MOE = NOEL (short-term NOEL = 60 mg/kg/day)/ daily dermal dose.
[d] Total MOE = NOEL (short-term NOEL = 60 mg/kg/day) / daily total dose.
[e] Engineering Controls
for Scenario 2a = water soluble packets, single layer clothing, no gloves.
for Scenario 3a = closed system, single layer of clothing, no gloves.
for Scenario 4 = enclosed cab, single layer no gloves.
for Scenario 5 = enclosed cab, single layer no gloves.

Table 6. Intermediate-Term Risk of Vinclozolin (Engineering Controls)

Exposure Scenario (Scen. #)	Risk Mitigation Measure					
	Engineering Controls[e]					
	Dermal Unit Exposure (mg/lb ai)	Inhalation Unit Exposure (ug/lb ai)	Daily Absorbed Dermal Dose (mg/kg/day)[a]	Daily Total Absorbed Dose (mg/kg/day)[b]	Dermal MOE[c]	Total MOE[d]
Mixer/Loader Risk						
Mixing/Loading Dry Flowables for Aerial Applications and Sprinkler Irrigation Systems (1a)	None	None	None	None	None	None
Mixing/Loading Dry Flowables for Groundboom Applications (1b)	None	None	None	None	None	None
Mixing/Loading Dry Flowables for Airblast Sprayer Applications (1c)	N/A	N/A	N/A	N/A	N/A	N/A
Mixing/Loading Wettable Powder for Aerial Applications Sprinkler Irrigation Systems (2a)	0.02	0.2	Turf = 0.23 Forest = 0.40 Crop = 0.03	0.24 0.42 0.03	5 3 40	5 3 40
Mixing/Loading Wettable Powder for Groundboom Applications (2b)			Crop = 0.007 Turf = 0.037	0.007 0.038	171 32	171 32
Mixing/Loading Wettable Powder for Airblast Sprayer Applications (2c)			Crop = 0.003 Forest = 0.013	0.003 0.014	400 92	400 92
Mixing/Loading Liquid (Flowable Conc.) for Aerial Applications and Sprinkler Irrigation Systems (3a)	0.007	0.08	Turf = 0.08 Forest = 0.14 Crop = 0.01	0.08 0.15 0.01	15 9 120	15 8 120
Mixing/Loading Liquid (Flowable Conc.) for Groundboom Applications (3b)			Crop = N/A Turf = 0.013	N/A 0.014	N/A 92	N/A 86
Mixing/Loading Liquid (Flowable Conc.) for Airblast Sprayer Applications (3c)			Crop = N/A Forest = 0.005	N/A 0.005	N/A 240	N/A 240
Mixing/Loading Liquid (Flowable Conc.) for Fogger Applications (3d)	No data	No data	No data	No data	No data	No data
Applicator Risk						
Aerial-Fixed Wing (liquid) (4)	0.005	0.068	Turf = 0.06 Forest = 0.1 Crop = 0.007	0.06 0.11 0.007	20 12 171	20 12 171
Aerial-Helicopter (liquid) (5)	0.002	0.002	Turf = 0.016 Forest = 0.012 Crop = 0.003	0.016 0.012 0.003	75 100 400	75 100 400
Groundboom Tractor (6)	Crop = N/A Turf = 0.0059	N/A 0.043	N/A 0.011	N/A 0.011	N/A 109	N/A 109
Fogging (7)	No Data	No Data	No Data	No Data	No Data	No Data
Airblast Sprayer (8)	0.016	0.4	Forest = 0.01 Crop = 0.003	0.01 0.003	120 400	120 400

Exposure Scenario (Scen. #)	Risk Mitigation Measure					
	Engineering Controls[e]					
	Dermal Unit Exposure (mg/lb ai)	Inhalation Unit Exposure (ug/lb ai)	Daily Absorbed Dermal Dose (mg/kg/day)[a]	Daily Total Absorbed Dose (mg/kg/day)[b]	Dermal MOE[c]	Total MOE[d]
Flagger Risk						
Flagging (liquid) (9)	0.0002	0.006	Turf = 0.002 Forest = 0.004 Crop = N/A	0.002 0.005 N/A	600 300 N/A	600 240 N/A
Mixer/Loader/Applicator						
Backpack Sprayer (10)	None	None	None	None	None	None
Low Pressure Handwand (11)	None	None	None	None	None	None
High Pressure Handwand (12)	No Data	No Data	No Data	No Data	No Data	No Data
Dip Treatment (13)	No Data	No Data	No Data	No data	No Data	No Data

N/A = Not applicable since previous MOE was over 100 or engineering controls not possible.
None = Engineering controls not possible.
[a] Daily dermal dose = (daily dermal exposure / 60 kg) * (dermal absorption rate 25.2%).
[b] Baseline Total Dose = (daily dermal exposure + daily inhalation exposure/60 kg) * (dermal absorption rate 25.2%).
[c] Dermal MOE = NOEL (intermediate-term NOEL = 1.2 mg/kg/day)/ daily dermal dose.
[d] Total MOE = NOEL (intermediate-term NOEL = 1.2 mg/kg/day) / daily total dose.
[e] Engineering Controls = for Scenarios 2a & 2b = water soluble packets, single layer clothing, no gloves.
for Scenarios 3a & 3b = closed mixing system, single layer clothing, no gloves.
for Scenario 4 = enclosed cab, single layer of clothing, no gloves.
for Scenario 5 = enclosed cab, single layer of clothing, no gloves.
for Scenario 6 = enclosed cab, single layer of clothing, no gloves.
for Scenario 8 = enclosed cab, single layer of clothing and chemical resistant gloves, no data available for the no glove scenario.
for Scenario 9 = enclosed cab, single layer of clothing, no gloves.

Table 7. Exposure Scenario Descriptions for Uses of Vinclozolin

Exposure Scenario (Number)	Data Source	Additional PPE[a]		Engineering Controls	Standard Assumptions[b] (8-hr work day)	Comments[c]
		Clothing	Equipment			
Mixer/Loader Exposure						
Mixing Dry Flowables (1a, 1b and 1c)	PHED V1.1	See footnotes on each exposure/risk table for clothing scenarios.	Open mixing dry flowables	N/A	80 acres groundboom 350 to 1,200 acres aerial	**Baseline:** Dermal and inhalation acceptable grades. Dermal = 7 to 26 replicates; Inhalation = 23 replicates. Low confidence in dermal data; high confidence in inhalation data. **PPE:** Dermal and inhalation acceptable grades. Dermal = 19 to 26 replicates; Inhalation = 23 replicates. High confidence in both dermal and inhalation data. PHED data used for baseline. Additional PPE values were calculated from PHED using 50% PF for coveralls.
Mixing Wettable Powder (2a, 2b and 2c)	PHED V1.1	See footnotes on each exposure/risk table for clothing scenarios.	Open mixing wettable powder	Water soluble packets.	80 acres groundboom 350 to 1,200 acres aerial	**Baseline:** Dermal and inhalation acceptable grades. Dermal = 7 to 45 replicates; Inhalation = 44 replicates; Low confidence in dermal data; Medium confidence inhalation data. **PPE:** Dermal and inhalation acceptable grades. Dermal = 22 to 45 replicates; Inhalation = 44 replicates; Medium confidence in dermal and inhalation data. **Engineering Control:** Dermal grades acceptable; inhalation all grades. Dermal = 5 to 15 replicates. Inhalation = 15 replicates. Low confidence for both dermal and inhalation exposure. PHED data used for baseline and engineering controls no PFs were necessary. Maximum PPE values calculated from PHED data using 50% PF for the addition of coveralls. 80% PF for the addition of dust/mist respirator.
Mixing Liquid (Flowable Concentrate) (3a, 3b, 3c and 3d)	PHED V1.1	See footnotes on each exposure/risk table for clothing scenarios.	Open mixing liquid	Closed mixing	80 acres groundboom 350 to 1,200 acres aerial	**Baseline:** Dermal and inhalation acceptable grades. Dermal = 53 to 122 replicates; Inhalation = 85 replicates; high confidence in both dermal and inhalation data. **PPE:** Dermal and inhalation acceptable grades. Dermal = 59 to 122 replicates; Inhalation = 85 replicates; high confidence in dermal and inhalation data. **Engineering Control:** Dermal and inhalation grades acceptable; Dermal = 0 to 22 replicates. Inhalation = 27 replicates. Low confidence in dermal data; high confidence in inhalation data. PHED data used for baseline and engineering controls no PFs were necessary. Maximum PPE values calculated from PHED data using 50% PF for the addition of coveralls.

Exposure Scenario (Number)	Data Source	Additional PPE[a]		Engineering Controls	Standard Assumptions[b] (8-hr work day)	Comments[c]
		Clothing	Equipment			
Applicator Exposure						
Aerial equipment (liquids) (4 and 5)	PHED V1.1	See footnotes on each exposure/risk table for clothing scenarios.	Open cab	Enclosed cab.	350 to 1,200 acres for fixed-wing 350 acres for helicopter	**Baseline (Fixed-wing):** Dermal grades A, B, C; inhalation all grades. Dermal = 1 to 17 replicates; Inhalation = 17 replicates. Low confidence for dermal and inhalation data. **Engineering Control (Fixed-wing):** Dermal grades A,B,C: inhalation grades A,B,C. Dermal = 24-48 replicates. Inhalation = 23 replicates. High confidence for dermal and inhalation data. **Engineering Control (Rotary wing):** Dermal grades A,B,C; inhalation acceptable grades. Dermal = 2 to 3 replicates. Inhalation = 3 replicates. Low confidence for dermal and inhalation data. PHED data were used for rotary wing, no PFs were necessary. PHED data used for baseline (fixed-wing), no PFs were necessary. For PPE a 50% PF was used for coveralls.
Groundboom (6)	PHED V1.1	N/A	N/A	Closed cab.	80 acres	**Baseline:** Dermal and inhalation acceptable grades. Dermal = 23 to 33 replicates; Inhalation = 22 replicates; High confidence in dermal and inhalation data. **PPE:** Dermal grades A,B,C. Dermal = 21 to 86 replicates. Medium confidence in dermal data. **Engineering Control:** Dermal grades A,B,C ("Best" available data); inhalation acceptable grades. Dermal = 16 to 20 replicates. Inhalation = 16 replicates. Medium confidence in dermal data and high confidence for the inhalation data. PHED data used for baseline, no PFs were necessary. For PPE a 50% PF was used for coveralls. For engineering control values, PHED data were used, no PFs were necessary.
Fogging (7)	No Data	No Data	No Data	No Data	No Data	No Data
Airblast Sprayer (8)	PHED V1.1	See footnotes on each exposure/risk table for clothing scenarios.	Open Cab	Closed cab.	40 acres	**Baseline:** Dermal and inhalation acceptable grades. Dermal = 22 to 49 replicates; Inhalation = 47 replicates. High confidence in both dermal and inhalation data. **PPE:** Dermal and inhalation acceptable grades. Dermal = 18 to 49 replicates, Inhalation = 47 replicates. High confidence data for both dermal and inhalation. **Engineering Control:** Dermal grades acceptable ("Best" available data); inhalation grades A,B,C. Dermal = 20 to 30 replicates. Inhalation = 9 replicates. High confidence dermal data and low confidence for inhalation data. PHED data used for baseline, no PFs were necessary. For intermediate-term scenario, the PPE values were calculated from PHED data using a 50% PF for the addition of coveralls. For intermediate-term scenario, the engineering control values were calculated from PHED, no PFs were necessary.
Flagger						

Exposure Scenario (Number)	Data Source	Additional PPE[a]		Engineering Controls	Standard Assumptions[b] (8-hr work day)	Comments[c]
		Clothing	Equipment			
Liquids (9)	PHED V1.1	See footnotes on each exposure/risk table for clothing scenarios.	N/A	Closed cab.	350 to 1,200 acres	**Baseline**: Dermal and inhalation grades acceptable. Dermal = 16 to 18 replicates; inhalation = 18 replicates. High confidence in dermal data and inhalation data. PHED data used for baseline values, no PFs were necessary. For PPE a 50% PF was used for coveralls, while a 90% PF was used for chemical resistant gloves.
Mixer/Loader Applicator						
Backpack Sprayer (10)	PHED V1.1	N/A	N/A	N/A	N/A	**Baseline:** Dermal grades A, B, C - Inhalation grades acceptable. Dermal = 9 to 1 replicates; inhalation = 11 replicates. Low confidence in both dermal and inhalation data. PHED data used derived from single layer with gloves. A 90% PF was taken off the hand exposure to simulate no gloves.
Low Pressure Handwand (11)	PHED V1.1	N/A	N/A	N/A	N/A	**Baseline:** Dermal and inhalation all grades. Dermal = 25 to 96 replicates; inhalation = 96 replicates. Low confidence in both dermal and inhalation data. PHED data used for baseline values, no PFs were necessary.
High Pressure Handwand (12)	No Data	No Data	No Data	No Data	No Data	No Data
Dip Treatment (13)	No Data	No Data	No Data	No Data	No Data	No Data

[a] Clothing represents the exposure estimates used in Table 2 and 3.
[b] Standard Assumptions based on an 8-hour work day as estimated by OREB. BEAD data were not available.
[c] "Acceptable grades," as defined by OREB SOP for meeting Subdivision U Guidelines are grades A and B. All grades that do not meet OREB's SOP are listed individually.

Table 8: Intermediate-term re-entry interval calculations for workers re-entering peach orchards in California, Pennsylvania, and Georgia.

DAT	Best Fit FDR (ug/cm²)[a]				Exposure (mg/day)[b]				Dose (mg/kg/day)[c]				MOE[d]			
	Site A	Site B	Site C	Average	Site A	Site B	Site C	Average	Site A	Site B	Site C	Average	Site A	Site B	Site C	Average[e]
0	0.28452	0.98222	0.55980	0.60885	6.6	22.8	13.0	14.2	0.110	0.38	0.217	0.237	43	13	22	20
1	0.25694	0.69042	0.49464	0.48067	6.0	16.1	11.5	11.2	0.100	0.27	0.192	0.187	48	18	25	25
2	0.23204	0.48531	0.43706	0.38480	5.4	11.3	10.2	8.9	0.090	0.19	0.170	0.148	53	25	28	32
3	0.20955	0.34114	0.38619	0.31229	4.9	7.9	9.0	7.3	0.082	0.13	0.150	0.122	58	37	32	39
4	0.18924	0.23979	0.34124	0.25676	4.4	5.6	7.9	6.0	0.073	0.09	0.132	0.100	65	53	36	48
5	0.1709	0.16856	0.30152	0.21366	4.0	3.9	7.1	5.0	0.067	0.07	0.118	0.083	71	68	40	57
6	0.15433	0.11848	0.26642	0.17974	3.6	2.8	6.2	4.2	0.060	0.047	0.103	0.070	79	101	46	68
7	0.13937	0.08323	0.23541	0.15267	3.2	N/A	5.5	3.6	0.053	N/A	0.092	0.059	90	N/A	52	81
8	0.12586	0.05854	0.20801	0.13080	2.9	N/A	4.8	3.0	0.048	N/A	0.080	0.051	99	N/A	60	93
9	0.11366	0.04115	0.18380	0.11287	2.6	N/A	4.3	2.6	0.043	N/A	0.072	0.043	111	N/A	66	111
10	0.10265	0.02893	0.162402	0.0980	N/A	N/A	3.8	N/A	N/A	N/A	0.063	N/A	N/A	N/A	76	N/A
11	0.0927	0.02033	0.143499	0.0855	N/A	N/A	3.3	N/A	N/A	N/A	0.056	N/A	N/A	N/A	85	N/A
12	0.08371	0.01429	0.126795	0.0749	N/A	N/A	2.9	N/A	N/A	N/A	0.048	N/A	N/A	N/A	99	N/A
13	0.0756	0.01005	0.112037	0.0659	N/A	N/A	2.6	N/A	N/A	N/A	0.043	N/A	N/A	N/A	111	N/A

The Transfer Coefficient for these studies is 2907 cm²/hr.

[a] Best Fit FDR (ug/cm²) = foliar dislodgeable residue; double sided leaves.
[b] Exposure (mg/day) = [(Best Fit FDR x Transfer Coefficient (2907 cm²/hr))/1000] x 8 hrs.
[c] Dose (mg/kg/day) = Exposure/60 kg.
[d] MOE = NOEL (1.2 for intermediate-term)/(Dose x dermal absorption rate 25.2%)
[e] Average MOE is based on the average FDR data, not the average MOE of sites A, B, and C.

N/A = MOE greater than 100 from the previous day.

Site A = California site
Site B = Georgia site
Site C = Pennsylvania site

Table 9 Intermediate-term re-entry interval calculations for workers re-entering strawberry fields at two California sites and a Michigan site.

DAT	Best Fit FDR (ug/cm²)[a]				Exposure (mg/day)[b]				Dose (mg/kg/day)[c]				MOE[d]			
	Site A	Site B	Site C	Avg.	Site A	Site B	Site C	Avg.	Site A	Site B	Site C	Avg.	Site A	Site B	Site C	Avg.[e]
0	1.5347	1.6413	0.5222	1.2327	9.2	9.8	3.1	7.4	0.153	0.164	0.052	0.123	31	29	92	39
1	1.4218	1.3150	0.4499	1.0622	8.5	7.9	2.7	6.4	0.142	0.131	0.045	0.106	34	36	106	45
2	1.3171	1.0535	N/A	0.9194	7.9	6.3	N/A	5.5	0.132	0.105	N/A	0.092	36	45	N/A	52
3	1.2202	0.8441	N/A	0.7994	7.3	5.1	N/A	4.8	0.122	0.084	N/A	0.080	39	57	N/A	60
4	1.1304	0.6762	N/A	0.6983	6.8	4.1	N/A	4.2	0.113	0.068	N/A	0.070	42	70	N/A	68
5	1.0472	0.5418	N/A	0.6123	6.3	3.3	N/A	3.7	0.105	0.054	N/A	0.062	45	88	N/A	77
6	0.9702	0.4341	N/A	0.5393	5.8	2.6	N/A	3.2	0.097	0.043	N/A	0.053	49	111	N/A	90
7	0.8988	N/A	N/A	0.4755	5.4	N/A	N/A	2.8	0.090	N/A	N/A	0.047	53	N/A	N/A	101
8	0.8326	N/A	N/A	0.4232	5.0	N/A	N/A	2.5	0.083	N/A	N/A	0.042	57	N/A	N/A	113
9	0.7713	N/A	N/A	N/A	4.6	N/A	N/A	N/A	0.077	N/A	N/A	N/A	62	N/A	N/A	N/A
10	0.7146	N/A	N/A	N/A	4.3	N/A	N/A	N/A	0.072	N/A	N/A	N/A	66	N/A	N/A	N/A
11	0.6620	N/A	N/A	N/A	4.0	N/A	N/A	N/A	0.067	N/A	N/A	N/A	71	N/A	N/A	N/A
12	0.6133	N/A	N/A	N/A	3.7	N/A	N/A	N/A	0.062	N/A	N/A	N/A	77	N/A	N/A	N/A
13	0.5681	N/A	N/A	N/A	3.4	N/A	N/A	N/A	0.057	N/A	N/A	N/A	84	N/A	N/A	N/A
14	0.5263	N/A	N/A	N/A	3.2	N/A	N/A	N/A	0.053	N/A	N/A	N/A	90	N/A	N/A	N/A
15	0.4876	N/A	N/A	N/A	2.9	N/A	N/A	N/A	0.048	N/A	N/A	N/A	99	N/A	N/A	N/A
16	0.4517	N/A	N/A	N/A	2.7	N/A	N/A	N/A	0.045	N/A	N/A	N/A	106	N/A	N/A	N/A

The Transfer Coefficient for these studies is 749 cm²/hr.

[a] Best Fit FDR (ug/cm²) = foliar dislodgeable residue; double sided leaves.
[b] Exposure (mg/day) = [(Best Fit FDR x Transfer Coefficient (749 cm²/hr))/1000] x 8 hrs.
[c] Dose (mg/kg/day) = Exposure/60 kg.
[d] MOE = NOEL (1.2 for intermediate-term)/(Dose x Dermal Absorption Rate 25.2%)
[e] Average MOE is based on the average FDR data, not the average MOE of sites A, B, and C.

N/A = MOE greater than 100 from the previous day.

Site A = Madera, CA (maximum reentry interval)
Site B = Fallbrook, CA
Site C = Conklin, MI (minimum reentry interval)

Table 11. Intermediate-term reentry interval calculations for workers re-entering turf in California, Pennsylvania, and Florida.

DAT	Best Fit FDR (ug/cm²)[a]				Exposure (mg/day)[b]				Dose (mg/kg/day)[c]				MOE[d]			
	CA	PA	FL	Avg.	CA	PA	FL	Avg.	CA	PA	FL	Avg.	CA[e]	PA[f]	FL	Avg.[g]
0	5.1285	12.436	4.0217	7.1954	350.7	850.3	275.0	491.99	5.85	14.17	4.58	8.20	0.81	0.34	1.04	0.58
1	4.4504	10.885	2.5349	5.9568	304.3	744.3	173.3	407.30	5.07	12.41	2.89	6.79	0.94	0.38	1.65	0.70
2	3.8620	9.5268	1.5978	4.9955	264.1	651.4	109.3	341.57	4.40	10.86	1.82	5.69	1.08	0.44	2.61	0.84
3	3.3514	8.3384	1.0071	4.2323	229.2	570.1	68.9	289.39	3.82	9.50	1.15	4.82	1.25	0.50	4.14	0.99
4	2.9083	7.2983	0.6348	3.6138	198.9	499.0	43.4	247.10	3.32	8.32	0.72	4.12	1.43	0.57	6.61	1.16
5	2.5238	6.3879	0.4001	3.1039	172.6	436.8	27.4	212.23	2.88	7.28	0.46	3.54	1.65	0.65	10.35	1.35
6	2.1901	5.5910	0.2522	2.6778	149.8	382.3	17.2	183.10	2.50	6.37	0.29	3.05	1.90	0.75	16.42	1.56
7	1.9005	4.8936	0.1590	2.3177	129.9	334.6	10.9	158.48	2.17	5.58	0.18	2.64	2.19	0.85	26.46	1.80
8	1.6493	4.2832	0.1002	2.0109	112.8	292.9	6.9	137.50	1.88	4.88	0.12	2.29	2.53	0.98	39.68	2.08
9	1.4312	3.7489	0.0632	1.7478	97.9	256.3	4.3	119.51	1.63	4.27	0.07	1.99	2.92	1.12	68.03	2.39
10	1.2420	3.2813	0.0398	1.5210	84.9	224.4	2.7	104.00	1.42	3.74	0.05	1.73	3.35	1.27	95.24	2.75
11	1.0778	2.8720	0.0251	3.9749	73.7	196.4	1.7	90.60	1.23	3.27	0.03	1.51	3.87	1.46	158.73	3.15
12	0.9353	2.5137	N/A	1.1549	64.0	171.9	N/A	78.97	1.07	2.87	N/A	1.32	4.45	1.66	N/A	3.61
13	0.8116	2.2001	N/A	1.0072	55.5	150.4	N/A	68.87	0.93	2.51	N/A	1.15	5.12	1.90	N/A	4.14
14	0.7043	1.9257	N/A	0.8788	48.2	131.7	N/A	60.09	0.80	2.20	N/A	1.00	5.95	2.16	N/A	4.76
15	0.6112	1.6855	N/A	0.7669	41.8	115.2	N/A	52.44	0.70	1.92	N/A	0.87	6.80	2.48	N/A	5.47
16	0.5304	1.4752	N/A	0.6694	36.3	100.9	N/A	45.77	0.61	1.68	N/A	0.76	7.81	2.83	N/A	6.27

N/A: MOE previously over 100, the Transfer Coefficient for these studies is 8,547 cm²/hr

[a] Best Fit FDR (ug/cm²) = foliar dislodgeable residue.

[b] Exposure (mg/day) = [(Best Fit FDR x Transfer Coefficient (8,547 cm²/hr))/1000] x 8 hrs.

[c] Dose (mg/kg/day) = Exposure/60 kg.

[d] MOE = NOEL (1.2 for intermediate-term)/(Dose x Dermal Absorption Rate 25.2%)

[e] The California site reached an MOE of 100 at 34 DAT.

[f] The Pennsylvania site reached an MOE of 100 at 43 DAT.

[g] The average MOE reached 100 at 37 DAT.

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